Congratulations! You have purchased the Data 20 Display Manager video expansion for the VIC-20. It will increase the screen size from 23 lines of 22 characters to either 24 lines of 40 characters or 24 lines of 80 characters. In addition, the Display Manager will optionally add 8K of memory to the 5K of memory already in the VIC.

The Display Manager comes complete with everything required for immediate upgrade of the VIC including:

1. The Display Manager cartridge.
2. Complete 40/80 column driver software resident in the cartridge. This allows programs from Commodore's larger machines to run on the VIC.
3. Terminal emulation software so that you can use the VIC as a high quality terminal to access computer data bases.

INSTALLING THE DISPLAY MANAGER

Installing the Display Manager is extremely easy. First, you must decide whether you want to use the Display Manager in 40 or 80 column mode. If you are using a T.V. set, the 40 column mode should be used for best results. Plug the Display Manager in the expansion slot in the rear of the VIC with the label facing up. Now, move the video cable to the video output of the Display Manager and power up the VIC. If you want 80 column operation, hold down the RUN/STOP key until the bytes free message appears. This indicates that the Display Manager is ready for use. If your unit has the optional 8K memory, the bytes free will go from 3583 to 11175. The Display Manager behaves almost exactly like the 22 column screen, but you should consult the section below on differences.

If you forget to hold down the RUN/STOP key, and the Display Manager software comes up in 40 columns when you wanted 80, hit the F7 key. Likewise, if you accidentally got 80 columns and wanted 40, this can be easily corrected by hitting the F5 key.

SPECIFICATIONS

Functions added	40 column by 24 line or 80 column by 24 line video and optionally 8K of memory
Video Column Selection	software selectable
Video Output	1.75V RS-170 compatible standard composite video 75 Ohm, Black and white
Video Output Connector	5 pin DIN, VIC 20 pinouts
Modulator Compatibility	Can use VIC video modulator in 40 column mode
Character Set	Full Commodore character set including all characters

Video Attributes supported	Reverse video
Video Memory	2K located at Hex 8800
User Memory Size	optional 8K
Memory organization	one 8K block that may be located at either Hex 2000 (decimal 8192) or at Hex 6000 (decimal 24576) switch selectable
Memory Technology	High reliability static
Firmware Capacity	2K located at Hex A000 consisting of one 2K ROM
Firmware Provided	2K video driver located at Hex A000
Dimensions	4½"L X 4½"W X 1" H including plastic case
Power Requirements	1 watt at 5V DC

DIFFERENCES BETWEEN VIC SCREEN AND THE DISPLAY MANAGER SCREEN

Line length:
The VIC allows an 88 column line (4 lines) for programs and data. The Display Manager allows 80 columns in 80 column mode; 40 columns in 40 column mode.

Switch to lower case:
The VIC switches to lower case by pressing the SHIFT and Commodore keys simultaneously. The Display Manager uses the F2 key to shift into lower case letters, F1 to unshift back to upper case.

Cursor:
The VIC turns the cursor off during program execution, while the Display Manager cursor is always on. To turn the cursor off, use the following: POKE 39928, 10:POKE 39929, 48. To turn the cursor on, use POKE 39928, 10:POKE 39929,96.

Null response to INPUT statement:
If a RETURN is entered as the response to an INPUT statement, the variable in that statement will remain unchanged on the VIC. On the Display Manager, a string variable will be set to the null string and a numeric variable will be set to 0.

Quote mode in PRINT or INPUT statements:
The VIC interprets cursor control characters within quotes as regular characters. The INSERT and DELETE keys toggle this function to allow using the cursor control keys to move the cursor. The Display Manager only allows cursor control characters to be entered when first entering the line. Subsequent edits use the cursor control keys to move cursor.

Additional features supported in the Display Manager:
To erase to end of the current line from the cursor position, press the F3 key. To erase to the end of the screen from the current cursor position, press the F4 key. To print the contents of the screen press the F8 key. To use this, device 127 must already be open (see the section on using the screen dump feature). This can be done by using the terminal mode (see below) or using an OPEN statement (see the Programmer's Reference Guide). The F6 key switches the software to 40 column mode, the F7 key switches the software to 80 column mode.

If it is necessary to read the function keys, use a GET statement instead of an INPUT. This allows the keys to be read with out them doing their above listed functions.

TERMINAL MODE

The Display Manager software has provisions to emulate a terminal. You can use the terminal mode in either 80 or 40 columns to access many remote data bases such as the Source and Compuserve in conjunction with the VIC Modem.

To use the terminal mode, all you have to do is first open the RS-232 port using the OPEN statement (see the programmer's reference guide for the particulars) and then hit the F8 key. It is not necessary to load the VICTERM program from tape. The exact form of the OPEN statement will vary from service to service, but there are only a few things to look for: speed of transmission, parity, word length, and duplex mode. A form that should work with most of them is: OPEN127,2,0,CHR$(6). To exit the terminal mode, just hit the F8 again.

When the remote computer sends certain codes, the terminal software responds as follows:

Code	Action	Code	Action
1	Cursor home	8	Cursor right
8	Back space	10	Line feed
12	Clear screen	13	Carriage return
21	Cursor left	28	Cursor up
26	Erase to end of line	29	Erase to end of page
30	Switch to reverse video	31	Switch to normal video

Key	Control Code	Key	Control Code
HOME	Cursor home 1	STOP	Control C 3
RIGHT	Cursor Right 6	F5	Bell 7
DEL	Back space 8	DOWN	Cursor Down 10
CLR	Clear screen 12	F1	CC1 17
F2	CC2 18	F3	CC3 19
F4	CC4 20	LEFT	Cursor left 21
F7	Control X 24	UP	Cursor up 28
INST	Escape 27	F8	Delete 127

Other control codes may be generated by using the Commodore key as the control key. The terminal mode is set to uppercase characters. You must press the shift key to get lower case.

The Display Manager can also be used with the Data 20 PRINTER INTERFACE to make a general purpose 40 or 80 column terminal. With the Data 20 PRINTER INTERFACE, the software can take advantage of the switches to automatically set the operating parameters. To enter the terminal mode, simply press the F8 key and it will be set up as follows:

SW1	SW2	Parity	SW3	SW4	Baud Rate	
OFF	OFF	MARK	OFF	OFF	1200	Switches
OFF	ON	EVEN	OFF	ON	600	5 and 6
ON	OFF	ODD	ON	OFF	300	should be
ON	ON	SPACE	ON	ON	110	left off

Word lengths are fixed at 7 bits with one start bit and one stop bit (except 110 baud which automatically has 2 stop bits).

USING THE MEMORY

The Display Manager cartridges have an option of 8K of memory. If your unit shows 11175 bytes free on power up, it has that memory in place. Should you require more memory than is available in the Display Manager you can use most of the 3K, 8K or 16K memory expanders on the market. To do so however, you will need some sort of an expansion chassis. Data 20 makes several varieties—please ask you dealer for the one that best suits your needs. The instructions below will help you if you have the 8K option installed. If you don't have the optional memory then you can plug in the appropriate memory combination as if the Display Manager were not in place at all.

To use a 3K memory, you will have to tell the computer that there is an extra 3K present because it doesn't look for that 3K if there is already 8K there. This statement will do the trick: POKE 642,4:SYS 58232. Upon doing this you will notice that the bytes free will go from 11175 to 15359. Be sure that there is no program present when you enter this command because it will clear the memory!

To use an 8K memory, set the memory cartridge to operate in block 2. Instructions to do this can be found in the manufacturer's literature.

A 16K memory requires that the 8K in the Display Manager be moved so that it resides in block 3. This can be accomplished by opening the case and moving the switch to the position marked block 3.

SCREEN DUMP

The screen dump feature is included in the Display Manager operating software. It has the ability to send the contents of the screen to most devices including: the serial bus printer (the VIC printer or a printer with a serial bus interface), an RS -232 printer, the Datasette, or a file on the disk drive. This feature can be accessed either with a BASIC program or from the keyboard.

A BASIC program must first open the device that is to receive the dump using the OPEN statement (device 127 must be used for the file number) and then it must send a CHR$(139). As an example, print the contents of the screen to the serial bus printer:

```
10 OPEN 127,4:REM THIS OPENS THE SERIAL
   BUS PRINTER
20 PRINT#127,CHR$(139):REM THIS CAUSES
   THE SCREEN TO DUMP
30 CLOSE 127
```

Dumping the screen from the keyboard requires only that you first open your device with the appropriate OPEN statement and then hit the F8 key. For example to dump the screen to an RS-232 printer running at 110 BAUD, use OPEN 127,2,0,CHR$(3) and then hit the F8 key.

If you happen to be using the screen dump in conjunction with a DATA 20 printer interface, you can use the terminal mode to open the RS-232 port without typing in an OPEN statement. Remember that the F8 key opens the terminal mode and its parameters are read from the switches. Pressing F8 again exits terminal mode but leaves the RS-232 port open. So, to use this little trick, hit the F8 twice and then the F6 and your screen will dump to the RS-232 port. Subsequent dumps only require you to hit the F6 key until the port is closed.

You can use the Display Manager with many other software cartridges. However, it is not possible to make it work with all of them. All of the cartridges that auto start like games won't work. Any cartridge that uses block 5 (they would have a SYS command greater that 40960) also won't work. But the good news is that many of the cartridges that use block 3 will work as long as you don't have any expansion memory there. If the cartridge was specifically designed to use the 22 column screen, you may find that the screen is still used.

For example the Commodore Programmer's Aid will work except that the functions that print to the screen like the TRACE still print to the 22 column screen. In order to use the Programmer's Aid you have to follow this procedure:

1. type in SYS 40975 (this returns control to the 22 column screen so you will have to move the video cable)
2. type in SYS 23681 (this activates the Programmer's aid
3. type in SYS 40978 (this re-starts the 40/80 column screen so you will have to the video cable back)

The VICMON cartridge will not work in 40 or 80 column mode. To use the VICMON, type in SYS 40975 to return to the 22 column screen, move the video cable, and activate the VICMON according to instructions. You will however, be able to take advantage of the extra memory when using the VICMON.

MACHINE LANGUAGE ACCESS TO INPUT AND OUTPUT ROUTINES

There are two routines accessible to the programmer: a character output routine and a line input routine. These are accessed with a JSR to hex A015 and A018 respectively.

On entry to the line input routine, the X register must be set to zero if a full line of data is desired upon exit from the editor. After a RETURN is entered, the editor will return with the character in the accumulator and with the X register set to the same value as on entry. To get each successive character, re-enter the routine, each time incrementing the X register until a carriage return character is returned.

To use the character output routine, place the desired character in the accumulator and JSR to A015. The character will be placed at the current cursor location and the cursor location will be incremented.

Display Manager Memory Map

Hex address	Decimal address	Function
9BF8	39928	CRT controller control register
9BF9	39929	CRT controller data register
9BFC	39932	Mode register Bit 0-1 selects lower case characters Bit 5-1 selects 80 columns 0 selects 40 columns
A000-A7FF	40960-43007	Driver software PROM
8800-BFFF	47104-49151	Video RAM-8800 is upper left corner, addresses are sequential character positions left to right

SYSTEM COMMANDS

Startup:
Normally, the Display Manager starts itself on power up. However, there will be times when it is necessary to start up the Display Manager from BASIC. To start it in 40 column mode, enter the command SYS 40969; for 80 column mode, enter SYS 40972.

Eighty column mode is only recommended for use with a video monitor, because the resolution required is beyond the capacity of a normal T.V. set. A video cable for use with most video monitors is available from Data 20—see your dealer.

Return to VIC mode:
To resume using the VIC 22 column screen after using the Display Manager, type in SYS 40972 (RETURN). Remember that you will have to move the video cable back to the VIC video output. Never enter this command when using the 22 column screen, doing so may destroy any program or data in memory. Note that the 22 column screen is left operational even when the Display Manager is running. There is nothing to keep you from using both concurrently if you wish.

Restart 40/80 column mode
This function can only be used after the return to VIC mode above. The command is SYS 40978 (RETURN). This command does not clear the screen. Never use this command in 40/80 column mode, doing so may destroy any program or data in memory.

QUICK REFERENCE GUIDE

STARTUP COMMANDS

SYS 40969	40 column mode
SYS 40972	80 column mode
SYS 40975	return to VIC 22 column screen
SYS 40978	restart 40 or 80 column mode (does not clear screen)

DIFFERENCES BETWEEN DISPLAY MANAGER SCREEN AND VIC 20 SCREEN

FEATURE	VIC 20 Screen	Display Manager
Line Length	88 Columns	40 or 80 columns
Switch to Lower Case	Press SHIFT and Commodore keys	Press F1 for shift. Press F2 for unshift
Null Response to Input Statement	Returns previous value of variable	Returns null string for string variable, 0 for numeric variable
Erase to end of line	Not supported	Press F3 key
Erase to end of screen	Not supported	Press F4 key
Screen Dump	Not supported	Press F5 key. RS232 port must already be open using device 127, can use CRT mode to do this
Terminal mode	Not supported	Press F6 key used with printer interface
Quote Mode In Print Or Input Statements	Allows putting cursor control characters in on subsequent edits. INSERT and DELETE toggles this function	Allows putting cursor control characters in only when first entering line
Cursor	off during program execution	always on

DATA 20 One Year Limited Warranty

DATA 20 warrants the Display Manager to be free of defects for one year from the date of purchase. This warranty is limited to replacement or repair of defects, at the discretion of DATA 20, in the Display Manager only. No liability is assumed for damage due to accident, misuse, lack of reasonable care, or for incidental or consequential damages.

To obtain warranty service, simply fill out the form below and send it along with a proof of purchase showing the name of the dealer where you bought your Display Manager and the date when it was purchased. Without this information your warranty service cannot be processed. Please send your Display Manager insured and shipping prepaid. Ship to:

DATA 20: ATTENTION: Warranty Service
23011 Moulton Parkway #B10
Laguna Hills, CA 92653

DATA 20: ATTENTION: Warranty Service
23011 Moulton Parkway #B10
Laguna Hills, CA 92653

Name

Address

City State Zip

Description of problem with the unit

Name of Dealer where purchased

How was your dealer service?